

## CLAIMS

What is claimed is:

- 1           1.     An article comprising:  
1                 a heat spreader including a die side and a heat-sink side; and  
2                 a container barrier disposed on the heat spreader die side, wherein the  
3           container barrier and the heat spreader form a recess upon the die side.
- 1           2.     The article of claim 1, further including:  
2                 a first channel through the heat spreader to communicate from the die  
3           side to the heat-sink side; and  
4                 optionally a first plug disposed in the first channel.
- 1           3.     The article of claim 1, further including:  
2                 a first channel through the heat spreader to communicate from the die  
3           side to the heat-sink side;  
4                 optionally a first plug disposed in the channel;  
5                 a second channel through the heat spreader to communicate from the  
6           die side to the heat-sink side; and  
7                 optionally a second plug disposed in the second channel.
- 1           4.     The article of claim 1, further including:  
2                 a first channel through the container barrier; and  
3                 a first plug disposed in the first channel, wherein the plug is gas-  
4           permeable and liquid-impermeable.
- 1           5.     The article of claim 1, further including:  
2                 a first channel through the container barrier;  
3                 a first plug disposed in the first channel, wherein the first plug is gas-  
4           permeable and liquid-impermeable;

5                   a second channel through the container barrier to communicate from  
6                   the die side to the heat-sink side; and  
7                   a second plug disposed in the second channel, wherein the second  
8                   plug is gas-permeable and liquid-impermeable.

1           6.       The article of claim 1, wherein the container barrier is selected from  
2           a solder, a leaded solder, a lead-free solder, a reactive solder, an indium material, a  
3           tin material, a silver material, a tin-silver material, a tin-silver-indium material, and  
4           combinations thereof.

1           7.       The article of claim 1, wherein the container barrier is selected from  
2           a metal; a polymer-solder hybrid; a polymer matrix and a metal preform; and a  
3           polymer matrix, a metal preform, and a middle heat transfer structure disposed  
4           therebetween.

1           8.       The article of claim 1, further including:  
2           a liquid heat-transfer medium disposed in the recess.

1           9.       The article of claim 1, further including:  
2                   a liquid heat-transfer medium disposed in the recess, wherein the  
3           liquid heat-transfer medium is selected from an organic composition, a  
4           metal, and combinations thereof.

1           10.      A package comprising:  
2                   a heat spreader including a die side and a heat-sink side;  
3                   a container barrier disposed on the heat spreader die side, wherein the  
4           container barrier and the heat spreader forms a recess upon the die side; and  
5                   a liquid heat-transfer medium disposed in the recess.

1           11.     The package of claim 10, wherein the heat spreader is selected from  
2     a heat slug, a heat pipe, and an integrated heat spreader.

1           12.     The package of claim 10, wherein the die side of the heat spreader  
2     includes a convoluted interface with the liquid heat-transfer medium.

1           13.     The package of claim 10, further including:  
2                 a first channel through the heat spreader to communicate from the die  
3     side to the heat-sink side; and optionally  
4                 a first plug disposed in the first channel.

1           14.     The package of claim 10, further including:  
2                 a first channel through the heat spreader to communicate from the die  
3     side to the heat-sink side;  
4                 optionally a first plug disposed in the first channel;  
5                 a second channel through the heat spreader to communicate from the  
6     die side to the heat-sink side;  
7                 optionally a second plug disposed in the second channel.

1           15.     The package of claim 10, further including:  
2                 a first channel through the container barrier;  
3                 optionally a first plug disposed in the first channel.

1           16.     The package of claim 10, further including:  
2                 a first channel through the container barrier;  
3                 optionally a first plug disposed in the first channel;  
4                 a second channel through the container barrier; and  
5                 optionally a second plug disposed in the second channel.

1           17.     The package of claim 10, further including:

2 a die in contact with the liquid heat transfer medium.

1 18. The package of claim 10, further including:  
2 a die in contact with the liquid heat transfer medium; and  
3 a mounting substrate coupled to the die.

1 19. A process comprising:  
2 forming a container barrier upon a heat sink substrate to achieve a  
3 recess, the recess including:  
4 a recess wall including the container barrier; and  
5 a recess base including the heat sink.

1 20. The process of claim 19, wherein forming the container barrier upon  
2 the heat sink is cold forming, selected from rolling, pressing, stamping, and  
3 combinations thereof.

1 21. The process of claim 19, wherein forming the container barrier upon  
2 the heat sink includes assembling a polymer-solder hybrid container barrier.

1 22. The process of claim 19, further including:  
2 disposing a liquid heat transfer medium in the recess.

1 23. A process comprising:  
2 forming a container barrier upon a die to achieve a recess, the die  
3 including an active surface and a backside surface, and the recess including:  
4 a recess wall including the container barrier; and  
5 a recess base including the die backside surface.

1 24. The process of claim 23, wherein forming the container barrier upon  
2 a die includes assembling a polymer-solder hybrid container barrier.

1           25.    The process of claim 23, further including:  
2                    assembling the container barrier upon a heat sink.

1           26.    The process of claim 23, further including:  
2                    disposing a liquid heat transfer medium in the recess.

1           27.    A computing system comprising:  
2                    a heat spreader including a die side and a heat-sink side;  
3                    a container barrier disposed on the heat spreader die side, wherein the  
4           container barrier and the heat spreader form a recess upon the die side;  
5                    a die in contact with the container barrier;  
6                    a liquid heat-transfer medium disposed in the recess; and  
7                    at least one of an input device and an output device coupled to the  
8           die.

1           28.    The computing system according to claim 27, wherein the computing  
2           system is disposed in one of a computer, a wireless communicator, a hand-held  
3           device, an automobile, a locomotive, an aircraft, a watercraft, and a spacecraft.

1           29.    The computing system according to claim 27, wherein the die is  
2           selected from a data storage device, a digital signal processor, a micro-controller, an  
3           application specific integrated circuit, and a microprocessor.